A Perspective on Untapped Potential of Titanium in India

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Agenda

• Introduction
• Production of Titanium from its ore
• Four keys to a Nation’s competitive advantage
• Untapped potential in India
• Major concerns
• Conclusion
Introduction

- Titanium is also known as “Space Age Metal” - application in space, defense, and aeronautics technology
- Fourth most abundant metal in earth’s crust
- Always bonded to other elements in nature
- Properties
  - Excellent corrosion resistance, high strength and low density
  - Strong and lightweight
    - As strong as steel, but weighing only 56% as much as steel - highest strength-to-weight ratio
    - Quite ductile, lustrous and metallic white in color
- 95% of Titanium ore extracted is refined into Titanium dioxide (TiO2)
Introduction

• Applications
  – Most of the uses of titanium revolve around titanium alloys - aerospace, military, industrial process, automotives, medical instruments, and other applications.
  – TiO2 - white permanent pigment used in paints, paper, toothpaste, plastics, inks, paper

• Occurrence
  – Estimated Global reserve base of Titanium ore is 2000 M Tonnes
  – Mineral deposits are dispersed worldwide - sites in Australia, United States, Canada, South Africa, India and several other countries
  – Main ores of Titanium - Ilmenite (91-96% TiO2), Rutile (45 - 65% TiO2), Brookite, Titanite and Perovskite
Production of Titanium from its Ore

- Ore Mining and Beneficiation
  - Ilmenite (FeTiO3) / Rutile (TiO2) / pigments
  - Ilmenite upgraded to either synthetic or converted to Titanium slag

- Extraction of Titanium Ore
  - Reduction of Titanium ore into Sponge
  - Melting of Sponge to form an Ingot

- Fabrication of ingots / forging / working
  - Ingot is converted into general mill products
  - Finished shapes from mill products
Ilmenite 45% - 50% TiO₂

Ilmenite (Sulphate) 45% - 55% TiO₂

Ilmenite (Chloride) 56% - 63% TiO₂

Leucoxene 65%-90% TiO₂

Rutile 92%-96% TiO₂

Titanium Slag 75%-86% TiO₂

Synthetic Rutile 90%-95% TiO₂

Titanium Pigment (Sulphate) 92%-95% Ti

Titanium Pigment (Chloride) 92%-95% Ti

Titanium Sponge (99% Ti)

Titanium Ingot (99.50% Ti)

Finished Shape Billets, Bars, Plates, Sheets, Strips, Tubes, etc.
Four keys to a Nation’s competitive advantage

• Professor Michael E. Porter ‘s four keys to a Nation’s competitive advantage
  – Demand conditions
  – Related and Supporting industries
  – Factor (input) conditions
  – Company strategy & rivalry

• Titanium not being produced commercially in India at present
Untapped Potential in India

- Excellent reserves of Titanium minerals like Ilmenite and Rutile
- Titanium bearing ilmenite deposits are estimated at around 375 – 400 Mt i.e. 21% of global deposits approx.
- Installed capacity only 1% approx. of the total world’s capacity
- Demand of around 150,000 t/yr of Titanium dioxide – Imports about 70% of it
- Per capita consumption of Titanium products in India is 0.4 kg - Per capita consumption in developed countries is 5 kg
- Titanium dioxide (TiO2) is a global industry worth USD 11 billion
- Global demand growth for TiO2 is estimated to average 2.7%/year in the 10 years to 2019
- Demand of TiO2 is expected to increase rapidly in India - adoption of new technologies in every field
- High growth rate of TiO2 consuming industries – Coating 10-12%, Plastics 11-14%, Printing inks 14-16%
Major Concerns

• Lack of National policy on Titanium
• Non availability of appropriate technology
  – Closely held by a few developed countries (Australia, South Africa, USA, Russia, Japan)
• Environmental concerns and Land availability
  – Titanium minerals located in the coastal regions of south India
  – Significant reserve in Tamil Nadu is in forest area
  – Andhra Pradesh and Orissa - concerns about marine life extinction
  – Production of one tone of synthetic rutile results in an equal amount of iron oxide, disposal of which is cumbersome
  – One tone of sulphate pigment results in about 13-14 tonnes of effluent and disposal of which is also very cumbersome
  – Most of the land is inhabited by local people
• Capital intensive industry
Conclusion

• Application of Titanium to be increased exponentially - with growing economy, advancement of new technologies and increasing development in the future

• Current market for Titanium in India is devoid of any major player

• Indian companies with experience and skills in related industries should venture

• Large investment, R&D, government support, know-how, project management skills would be extremely essential

• Collaboration with foreign partners with know-how, technology and experience

• Different players may come up with complementary strengths
Thank You!